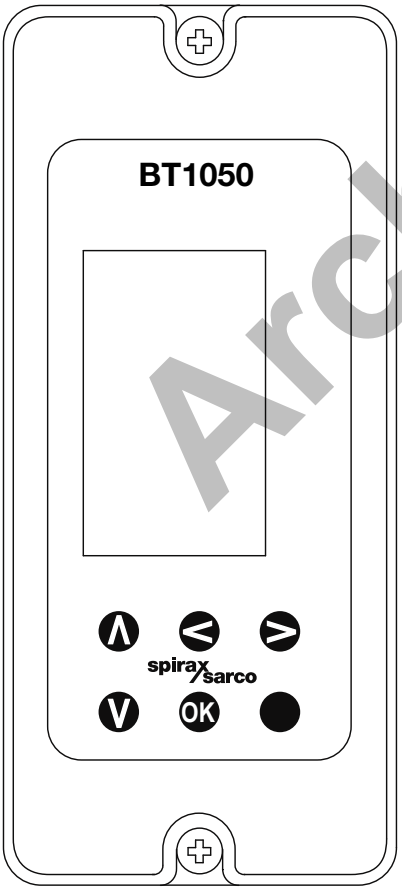
IM-P405-39
AB Issue 1

BT1050
Boiler Blowdown Timer
Installation and Maintenance Instructions



Archive

1. *Safety information*
2. *General product and delivery information*
3. *System overview*
4. *Mechanical installation*
5. *Electrical installation*
6. *Commissioning*
   - *Quick set-up*
   - *Full*
7. *Communications*
8. *Maintenance*
9. *Fault finding*
10. *Technical information*
    - *Default settings*
11. *Appendix*
    - *Summary of the Modbus protocol*
12. *Menu map*

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1. Safety information

Safe operation of this product can only be guaranteed if it is properly installed, commissioned, used and maintained by qualified personnel (see Section 1.11) in compliance with the operating instructions. General installation and safety instructions for pipeline and plant construction, as well as the proper use of tools and safety equipment must also be complied with.

In the UK, your attention is drawn to IEE Regulations (BS 7671). Elsewhere, other regulations will normally apply.

All wiring materials and methods shall comply with relevant EN and IEC standards where applicable.

Warning

This product is designed and constructed to withstand the forces encountered during normal use. Use of the product other than as a boiler controller, or failure to install the product in accordance with these Instructions, product modifications or repair could:

- **Cause injury or fatality to personnel.**
- **Cause damage to the product / property.**
- **Invalidate the CE marking.**

These instructions must be stored in a safe place near the product installation at all times.

Warning

This product complies with Electromagnetic Compatibility Directive 2004/108/EC and all its requirements.

This product is suitable for Class A Environments (e.g. industrial). A fully detailed EMC assessment has been made and has the reference number UK Supply BH BT1050 2008.

The product may be exposed to interference above the limits of Heavy Industrial Immunity if:

- **The product or its wiring is located near a radio transmitter.**
- **Excessive electrical noise occurs on the mains supply. Power line protectors (ac) should be installed if mains supply noise is likely. Protectors can combine filtering, suppression, surge and spike arrestors.**
- **Cellular telephones and mobile radios may cause interference if used within approximately 1 metre (39") of the product or its wiring. The actual separation distance necessary will vary according to the surroundings of the installation and the power of the transmitter.**

This product complies with Low Voltage Directive 2006/95/EC by meeting the standards of:-

- **EN 61010-1:2001 Safety requirements for electrical equipment for measurement, control, and laboratory use.**

Static precautions (ESD)

Static precautions must be observed at all times to avoid damage to the product.

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Symbols

Equipment protected throughout by double insulation or reinforced insulation.

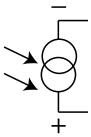
Functional earth (ground) terminal, to enable the product to function correctly.
Not used to provide electrical safety.

Clean earth / ground.

Safety earth.

Caution, risk of electric shock.

Caution, risk of danger, refer to accompanying documentation.



Optically isolated current source or sink.

Caution, Electrostatic Discharge (ESD) sensitive circuit. Do not touch or handle without proper electrostatic discharge precautions.

ac, alternating current

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1.1 Intended use

i) Check that the product is suitable for use with the intended fluid.

ii) Check material suitability, pressure and temperature and their maximum and minimum values. If the maximum operating limits of the product are lower than those of the system in which it is being fitted, or if malfunction of the product could result in a dangerous overpressure or overtemperature occurrence, ensure a safety device is included in the system to prevent such over-limit situations.

iii) Determine the correct installation situation and direction of fluid flow.

iv) Spirax Sarco products are not intended to withstand external stresses that may be induced by any system to which they are fitted. It is the responsibility of the installer to consider these stresses and take adequate precautions to minimise them.

v) Remove protection covers from all connections and protective film from all name-plates, where appropriate, before installation on steam or other high temperature applications.

1.2 Access

Ensure safe access and if necessary a safe working platform (suitably guarded) before attempting to work on the product. Arrange suitable lifting gear if required.

1.3 Lighting

Ensure adequate lighting, particularly where detailed or intricate work is required.

1.4 Hazardous liquids or gases in the pipeline

Consider what is in the pipeline or what may have been in the pipeline at some previous time. Consider: flammable materials, substances hazardous to health, extremes of temperature.

1.5 Hazardous environment around the product

Consider: explosion risk areas, lack of oxygen (e.g. tanks, pits), dangerous gases, extremes of temperature, hot surfaces, fire hazard (e.g. during welding), excessive noise, moving machinery.

1.6 The system

Consider the effect on the complete system of the work proposed. Will any proposed action (e.g. closing isolation valves, electrical isolation) put any other part of the system or any personnel at risk?

Dangers might include isolation of vents or protective devices or the rendering ineffective of controls or alarms. Ensure isolation valves are turned on and off in a gradual way to avoid system shocks.

1.7 Pressure systems

Ensure that any pressure is isolated and safely vented to atmospheric pressure. Consider double isolation (double block and bleed) and the locking or labelling of closed valves. Do not assume that the system has depressurised even when the pressure gauge indicates zero.

1.8 Temperature

Allow time for temperature to normalise after isolation to avoid danger of burns.

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1.9 Tools and consumables

Before starting work ensure that you have suitable tools and / or consumables available. Use only genuine Spirax Sarco replacement parts.

1.10 Protective clothing

Consider whether you and / or others in the vicinity require any protective clothing to protect against the hazards of, for example, chemicals, high / low temperature, radiation, noise, falling objects, and dangers to eyes and face.

1.11 Permits to work

All work must be carried out or be supervised by a suitably competent person. Installation and operating personnel should be trained in the correct use of the product according to the Installation and Maintenance Instructions.
Where a formal 'permit to work' system is in force it must be complied with. Where there is no such system, it is recommended that a responsible person should know what work is going on and, where necessary, arrange to have an assistant whose primary responsibility is safety.
Post 'warning notices' if necessary.

1.12 Handling

Manual handling of large and / or heavy products may present a risk of injury. Lifting, pushing, pulling, carrying or supporting a load by bodily force can cause injury particularly to the back. You are advised to assess the risks taking into account the task, the individual, the load and the working environment and use the appropriate handling method depending on the circumstances of the work being done.

1.13 Residual hazards

In normal use the external surface of the product may be very hot.
Many products are not self-draining. Take due care when dismantling or removing the product from an installation.

1.14 Freezing

Provision must be made to protect products which are not self-draining against frost damage in environments where they may be exposed to temperatures below freezing point.

1.15 Disposal

On disposal of the unit or component, appropriate precautions should be taken in accordance with Local / National regulations.

Unless otherwise stated in the Installation and Maintenance Instructions this product is recyclable and no ecological hazard is anticipated with its disposal providing due care is taken.

1.16 Returning products

Customers and stockists are reminded that under EC Health, Safety and Environment Law, when returning products to Spirax Sarco they must provide information on any hazards and the precautions to be taken due to contamination residues or mechanical damage which may present a health, safety or environmental risk. This information must be provided in writing including Health and Safety data sheets relating to any substances identified as hazardous or potentially hazardous.

Archive

2. General product and delivery information

2.1 General description

The BT1050 is a timer for the control of a bottom blowdown valve.

It allows a valve at the bottom of the boiler to open, removing precipitated solids that could otherwise build up, eventually causing damage.

The product can be panel, DIN rail or chassis mounted and is powered by a 99 - 264 Vac mains supply.

2.2 Front panel

The front panel has an LCD graphics display and five-button keypad:

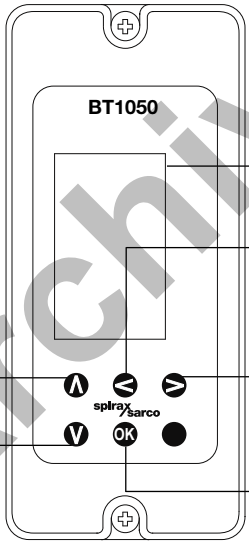

Fig. 1 Front panel keypad and definitions

Graphic display.

Exit sub-menus and shift left to the next digit when the parameter or digit is flashing.

Enter sub-menus and shift right to the next digit when the parameter or digit is flashing.

Scroll up menus / sub-menus. Increase digits.

Scroll down menus /sub-menus. Decrease digits.

Enters parameters when the parameter or digit is flashing. Hold down for 5 seconds to enter commissioning mode.

The ∧ and ∨ buttons are used to:

- scroll up and down through the menus and sub-menus.
- increase or decrease digits when in a menu or sub-menu.

The < and > buttons are used to:

- exit and enter sub-menus.
- shift left and right to a flashing digit or parameter when in a menu or sub-menu.

The OK button is used to:

- enter your choice of digit or parameter, when the digit or parameter is flashing.
- enter the commissioning mode (press and hold for five seconds).

Commissioning sets the product parameters, and allows the user to set and test the outputs, and to change the pass code - See Section 6.

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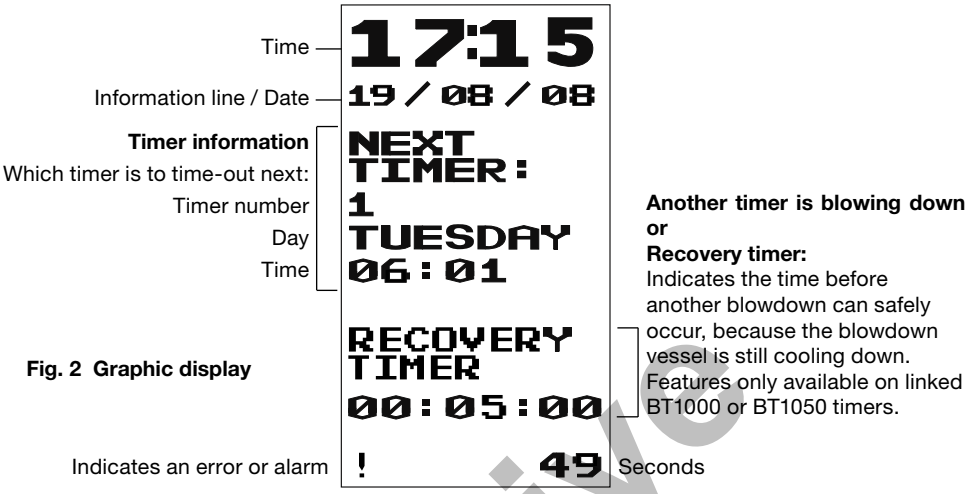

Fig. 2 Graphic display

Data to be edited is always displayed on the bottom right of the screen. Pressing the OK button will enter new data. Pressing the ∧ and ∨ buttons will scroll through the available data and the previously entered selection will flash.

In run (normal) mode, the display is divided into four main sections:

- Current time.
- Information line / Date.
- Timer information.
- Recovery time.

Operating parameters are selected using a software menu.

2.3 Information line details (in priority order)

Alarm:

- **'TEST ALM' -** the operator is testing the alarm relay. The relay is either energised (OFF) or de-energised (ON) for 5 minutes. See the commissioning mode TEST-OUTPUT-ALARM menu.
- **'ALARM' -** an error or fault has occurred. See details in the error screen in run mode and Section 9, 'Fault finding'.

Bottom blowdown valve (BB):

- **'TEST BB' -** the operator is testing the blowdown relay. The relay is either energised (ON) or de-energised (OFF) for 5 minutes. See the commissioning mode TEST-OUTPUT-VALVE menu.
- **'MAN OFF' -** the timer is switched off. e.g. manual override. The timer will ignore all pre-recorded times. See the commissioning MODE-OFF menu.
- **'MAN OPEN' -** the valve has been opened continuously. e.g. manual override. See the commissioning MODE-ON menu.
- **'DELAYED' -** a blowdown is overdue but cannot occur until the RECOVERY TIMER elapses.
- **'BLOWDOWN' -** a timed blowdown is occurring. i.e. the valve is open.

Archive

2.4 Alarm / error display messages

If an error occurs, an exclamation mark (**!**) will flash in the bottom left corner of the run display (see Figure 2). The details of the error or alarm will appear on a new message screen (see Figure 3), which can be accessed by scrolling through the run menu. Pressing and holding the OK button for 3 seconds can clear a message and re-energize the alarm relay(s). If the cause has not been corrected, the same message will reappear. If the error or alarm is of a latching type, only the message will disappear. The alarm relay will remain de-energised until the correct pass code is entered in the commissioning menu. If more than one error or alarm has occurred, the next message will appear (in priority order) after the previous one has been cleared. See Section 9, 'Fault Finding'.

If there are any problems with the product, error or alarm will appear. The example shows a power failure.

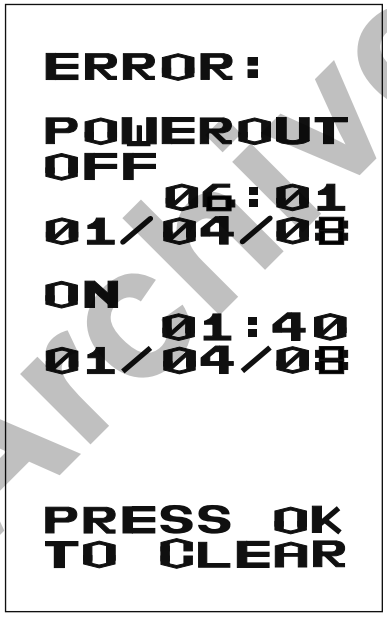

Fig. 3 Error display

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2.5 Other features

A test function provides the operator with a diagnostic tool.

The BT1050 can communicate via an Infrared link between adjacent units. It can be designated as either a slave or a master unit – see Section 7, 'Communications'.

2.6 Equipment delivery, handling and storage

Factory shipment
The product is tested, calibrated and inspected prior to shipment, to ensure reliable operation.

Receipt of shipment
Each carton should be inspected at the time of delivery for possible external damage. Any visible damage should be recorded immediately on the carrier's copy of the delivery slip.

Each carton should be unpacked carefully and its contents checked for damage. If it is found that some items have been damaged or are missing, notify Spirax Sarco immediately and provide full details. In addition, damage must be reported to the carrier with a request for their on-site inspection of the damaged item and its shipping carton.

Storage
If the product is to be stored for a period prior to installation, the environmental storage conditions should be at a temperature between 0°C and 65°C (32°F and 149°F), and between 10% and 90% relative humidity (non-condensing).

Ensure there is no condensation within the unit before installing and connecting the power.

Archive

3. System overview

The BT1050 controls the opening and closing of a valve at the bottom of the boiler to remove precipitated solids that could otherwise build up, eventually causing damage.

Each BT1050 has three timers. These allow different blowdown cycle times and durations to be set, for example, different times at weekends. Up to three blowdown cycles can be selected during one day.

The timers are also used to prioritise boiler blowdown cycles. This:

- allows recovery time (for water in a blowdown vessel to cool),
- minimises waste of heat and water,
- selects the most suitable blowdown time (i.e. avoiding peak steam demand times).

Up to nine BT1050 units can be installed and linked for multi-boiler installations, preventing more than one boiler blowing down at a time. This feature avoids the possibility of overloading a blowdown vessel, which could lead to water being discharged to drain at too high a temperature.

Inputs
The timer is connected directly to the mains supply.

Function / output
On expiry of the set time, a relay energises to open the bottom blowdown valve for the duration selected. After this, the valve closes until the next blowdown cycle.

If the blowdown valve is fitted with a switch box, an alarm relay can be released if the valve fails to open or to close within a set time (see Commissioning – Section 6.3.9, 'Alarm sub-menu').

4. Mechanical installation

Note: Read the 'Safety information' in Section 1 before installing the product.

The product must be installed in a suitable industrial control panel or fireproof enclosure to provide impact and environmental protection. A minimum of IP54 (EN 60529) or Type 3, 3S, 4, 4X, 6, 6P and 13 (UL50/NEMA 250) is required.
This product meets the requirements of Clause 23.2 of UL508 and can be considered part of the 5 VA fire enclosure for industrial use.

4.1 Environmental conditions

Install the product in an environment that minimises the effects of heat, vibration, shock and electrical interference (see Section 1 – 'Safety information').

Do not install the product outdoors without additional weather protection.

4.2 Installation on a DIN rail

The product is provided with a clip and a set of self-tapping screws to secure it to a 35 mm DIN rail. On the rear of the enclosure, two sets of holes are provided to give two height positions. The clip can be adjusted to give further positions. Locate the clip onto one set of holes and secure it using the two screws provided. Ensure the spring clip is fully engaged with the rail.

Warning: Only use the screws provided with the product.

4.3 Installation on a chassis plate:

- Drill holes in chassis plate as shown in Figure 4.
- Fit unit to chassis plate and secure with 2 screws, nuts and washers, using the slots provided at the top and bottom of the case.

Warning: Do not drill the product case or use self-tapping screws.

4.4 Installation in a panel cutout:

(Minimum panel thickness 1 mm if the bezel is used).

- The product has integral threaded inserts (M4 x 0.7) at the top and bottom of the front panel.
- Two M4 x 25 mm screws are provided, together with fibre washers and a bezel.

Warning:
Do not use screws over 25 mm in length – danger of electric shock.

- Cut the panel to the dimensions given in Figure 4. Drill the screw holes in the panel in the positions indicated.
- Remove the backing from the gasket supplied and apply to front face of the product.
- The bezel can be used to enhance the appearance of the panel cutout. If required, fit this to the outside of the panel.
- Fit the unit from the rear of the panel, and secure using the screws, washers (and bezel) provided.
- Tighten the M4 screws to 1.0 - 1.2 Nm.

WARNING: Do not drill the product case or use self-tapping screws.

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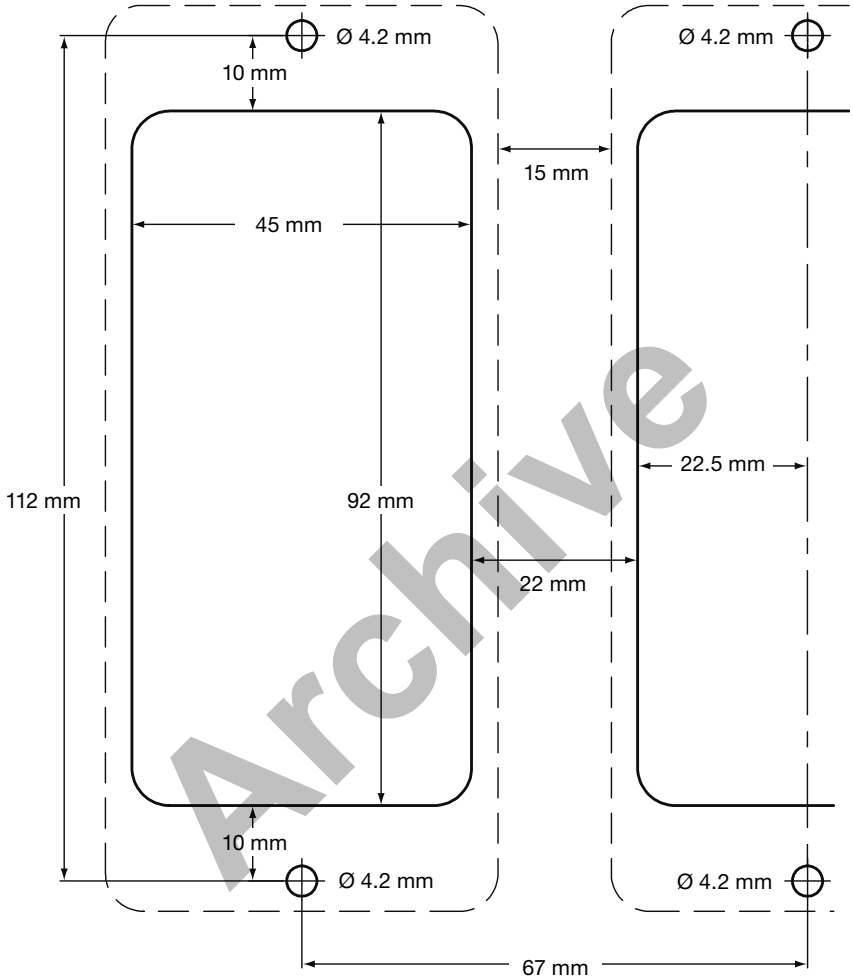

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Fig. 4 Chassis plate / panel – cutout diagram

Fixing template cutout notes:

- Solid line indicates cutout required for panel mounting.
- Broken line indicates product outline.
- A minimum gap of 15 mm between units must be provided for product cooling.
- Mounting hole dimensions are the same for both panel and wall mounting.

5. Electrical installation

Note: Before installing read the 'Safety Information' in Section 1.

Warning:
Isolate the mains supply before touching any of the wiring terminals as these may be wired to hazardous voltages.
Use only the connectors supplied with the product, or spares obtained from Spirax Sarco Limited. Use of different connectors may compromise product safety and approvals. Ensure there is no condensation within the unit before installing and connecting the power.

5.1 General wiring notes

Every effort has been made during the design of the product to ensure the safety of the user but the following precautions must be observed:

1. Maintenance personnel must be suitably qualified to work with equipment having hazardous live voltages.

2. Ensure correct installation. Safety may be compromised if the installation of the product is not carried out as specified in this IMI.

3. The design of the product relies on the building installation for overcurrent protection and primary isolation.

4. Overcurrent protection devices rated at 3 amps must be included in all phase conductors of the installation wiring. If overcurrent protection is included in both supply wires then the operation of one must also cause the operation of the other. Refer to IEC 60364 (Electrical Installations of Buildings) or National or Local standards for full details of requirements for overcurrent protection.

5. A 3 A quick-blow overcurrent protection device must be fitted to the relay circuit(s).

6. Relay contacts must be supplied on the same phase as the mains supply.

7. The product is designed as an installation category III product.

8. Install wiring in accordance with:
   - IEC 60364 - Low-voltage electrical installations.
   - EN 50156 Electrical Equipment for furnaces and ancillary equipment.
   - BS 6739 - Instrumentation in Process Control Systems: Installation design and practice or local equivalent.
   - National and Local Electrical Code (NEC) or Canadian Electrical code (CEC) for the US and Canadian markets. Note; use NEC Class 1 wire with a temperature rating greater than 75°C. If the cable is to be exposed to a higher temperature, then a higher temperature rating needs to be selected.

9. It is important that the cable screens are connected as shown in order to comply with the electromagnetic compatibility requirements.

Archive

10. All external circuits must meet and maintain the requirements of double/reinforced installation as stated in IEC 60364 or equivalent.

11. Additional protection must be provided to prevent accessible parts (e.g. signal circuits) from becoming Hazardous Live if a wire or screw is accidentally loosened or freed. Ensure all wires are secured to at least one other wire from the same circuit. The attachment must be as close to the terminal block as possible but must not apply undue stress on the connection. Example: Use a cable tie to secure the live and neutral wire together. If one wire becomes loose the other wire will prevent it from touching accessible parts.

12. A disconnecting device (switch or circuit breaker) must be included in the building installation. It must:

- Have a rating with sufficient breaking capacity.
- Be in close proximity to the equipment, within easy reach of the operator, but not fitted in a position that makes it difficult to operate.
- Disconnect all phase conductors.
- Be marked as the disconnecting device for the product.
- Not interrupt a protective earth conductor.
- Not be incorporated into a mains supply cord.
- Comply with the requirements for a disconnecting device specified in IEC 60947-1 (Specification for low-voltage switchgear and control gear – General rules) and IEC 60947-3 (Switches, disconnectors, switch-disconnectors and fuse-combination units).

13. See Section 10 – 'Technical information' for terminal and cable specification.

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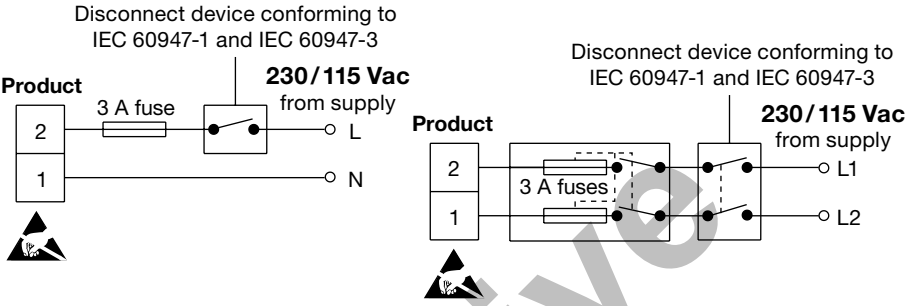
5.2 Mains wiring notes:

1. Read Section 5.1, General Wiring notes, before attempting to wire the supply to the product.

2. Fuses must be fitted in all live conductors.



3. Double or reinforced insulation must be maintained between:

- Hazardous live conductors (mains and relay circuits) and
- Safety extra low voltages (All other components/ connectors/ conductors).

4. The wiring diagrams show relays and switches in the **Power off** position.

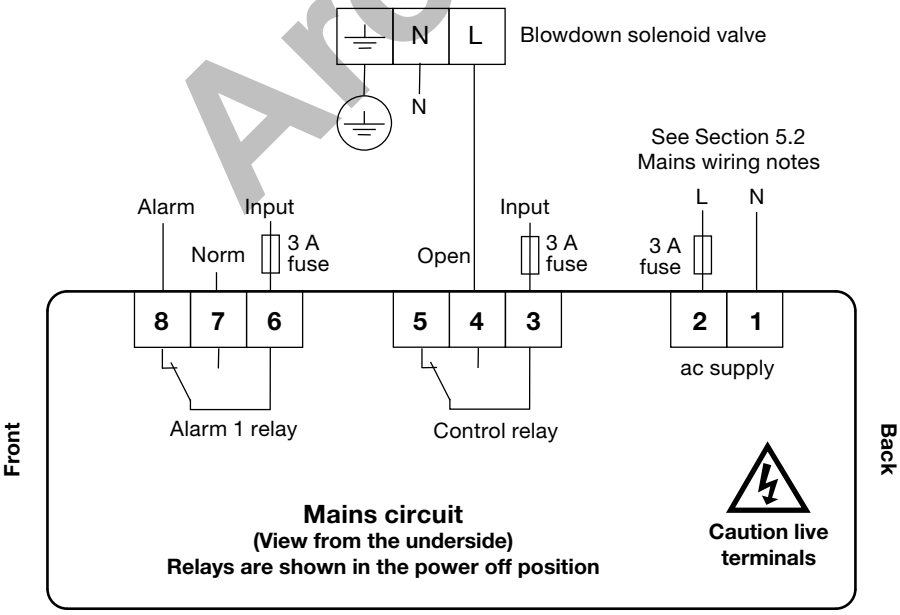


Fig. 5 Mains circuit

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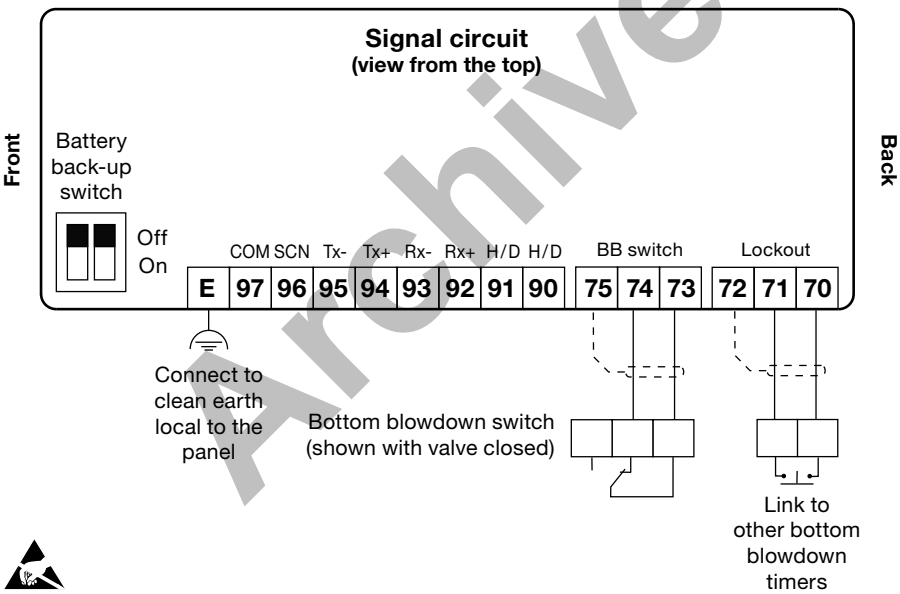
5.3 Signal wiring notes

An earth current loop is created if a wire or screen is connected between two earth points that are at different potential (voltage). If the wiring diagram is followed correctly, the screen will only be connected to the earth at one end.

The earth terminal is a functional earth rather than a protective earth.

A protective earth provides protection from electric shock under a single fault condition. This product has double insulation and therefore does not require a protective earth. A functional earth is used in order for the product to operate. In this application, the earth is used as a sink or drain for any electrical interference. The earth terminal must be connected to a local earth in order to conform to the EMC directive.


Signal circuit
(view from the top)
Front
Back
Battery back-up switch
Off
On
COM SCN Tx- Tx+ Rx- Rx+ H/D H/D
BB switch
Lockout
E 97 96 95 94 93 92 91 90 75 74 73 72 71 70
Connect to clean earth local to the panel
Bottom blowdown switch (shown with valve closed)
Link to other bottom blowdown timers

Archive

Notes:
E = Functional earth – Connect these pins to a clean earth local to the panel.
Switch battery back-up switches ON to activate battery.

Fig. 6 Signal circuit

5.4 EIA/TIA-485 communication wiring diagram

The product can be connected as a slave to a two or four-wire EIA/TIA-485 multi-drop network.

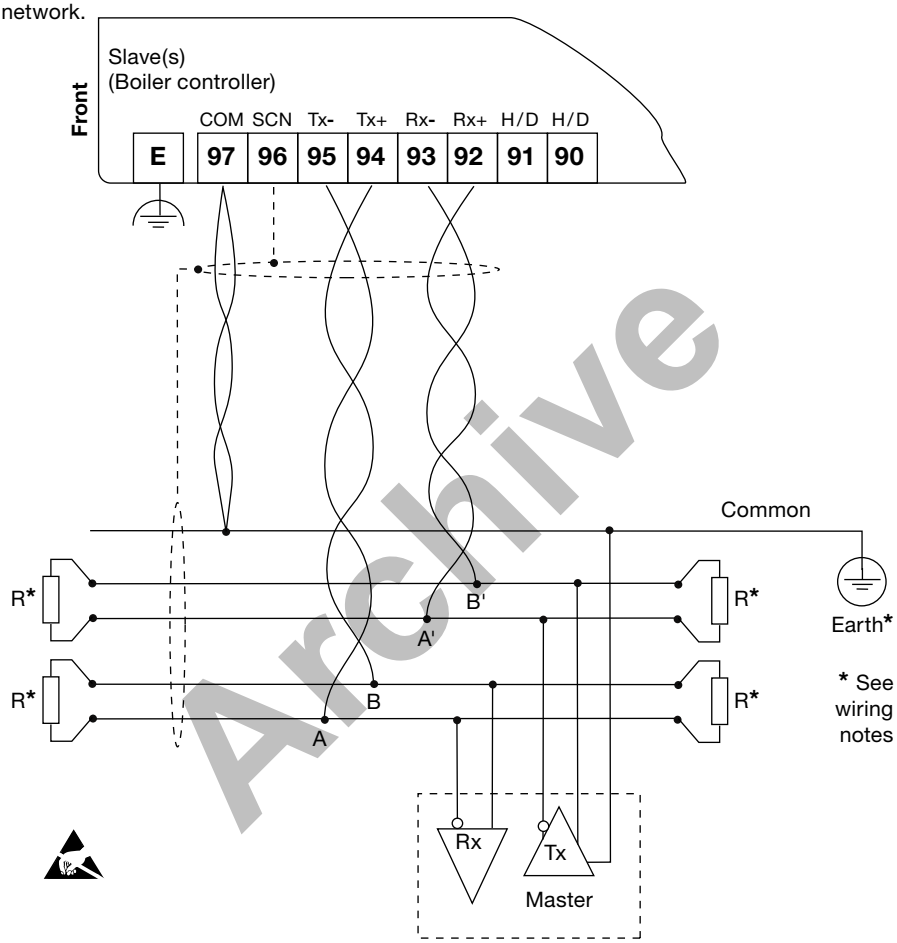


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Fig. 7 RS485/Modbus full duplex circuit (view from the top)

EIA/TIA-485 wiring notes:

EIA / TIA-485 symbols are used (A = Tx-, B = Tx+ and A' = Rx-, B' = Rx+)

The signal direction is relative to the product being the Modbus slave, i.e. Tx+ from the product (slave) is to be connected to the Rx+ of the master.

- Twisted pair cable should not be required for short lengths of cable < 1.5 m (< 5 ft). Standard screened cable should suffice.
- The H/D (Half duplex) pins are used to select two or four-wire Modbus:
  i) For two-wire mode, connect terminal 91 and 90 together.
  ii) For four-wire mode, **do not connect terminals 91 and 90 together.**

Continued on page 17

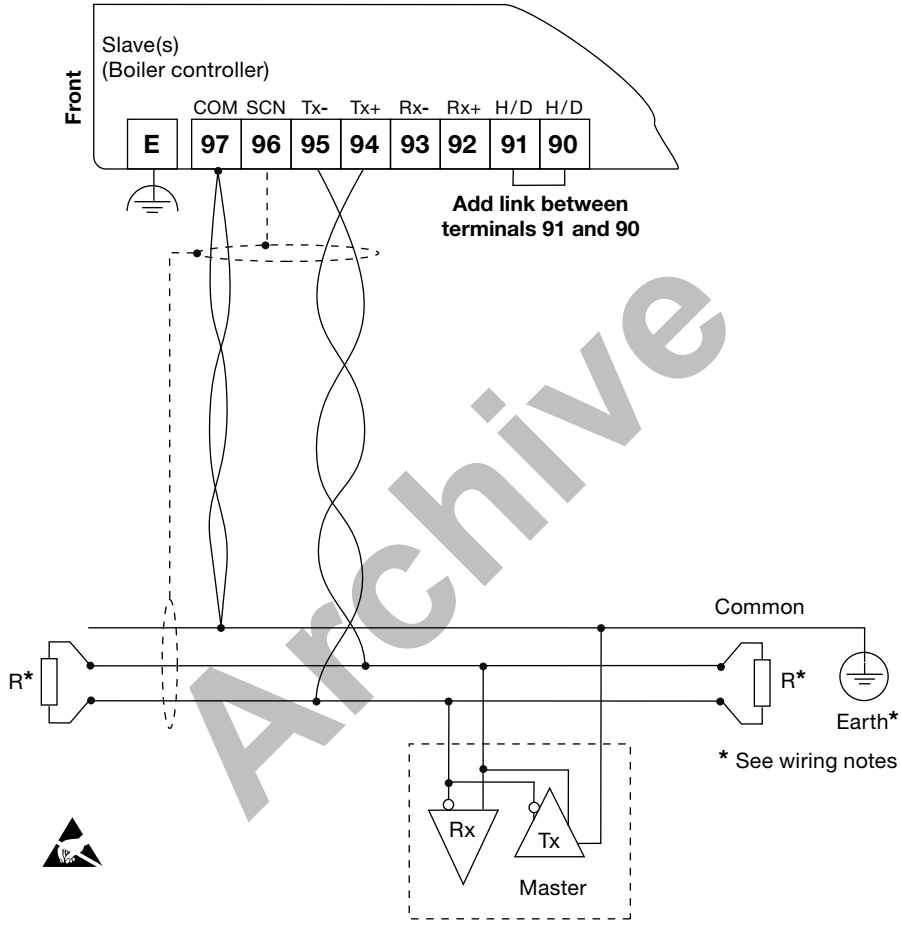

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Fig. 8 RS485/Modbus half duplex circuit (view from the top)

EIA/TIA-485 wiring notes continued:

- The bus common must be connected directly to protective ground/earth at one point only. Generally this point is at or near the master device.
- Consider terminating the two furthest ends of the bus to match the transmission line impedance. A 150 ohm (0.5 W) resistor or a 120 ohm (0.25 W) resistor, which is decoupled with a 1 nF (10 V) capacitor is commonly used, but ideally the line impedance should be matched to each individual installation. Termination for short lengths of cable should not be necessary < 300 m (< 1 000 ft) @ 9 600 Baud.
- See 'Technical information' for cable details.

The programmed settings are held in non-volatile memory (Flash) and are written to after changing a parameter and pressing the OK button. For quick set-up see Section 6.2.
An internal battery is used to keep the clock calendar running when the mains supply is switched off. To connect the battery, set both switches of SWI (see Section 5.3), to the on/down position.
Note: If the product has been powered down with the battery switched off, the display will show a spurious time and date on power up. To correct this, switch on the battery and enter the correct time and date.

6.1 General information

All commissioning for the product is carried out using the front panel. The front panel consists of a graphics display and a 5-button keypad - See Figure 9 and Section 2.

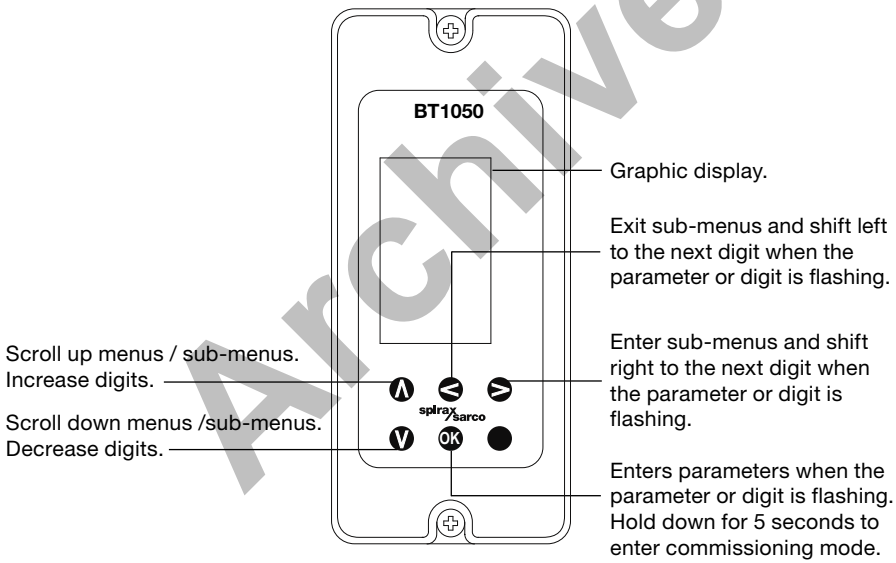

BT1050
Graphic display.
Exit sub-menus and shift left to the next digit when the parameter or digit is flashing.
Scroll up menus / sub-menus. Increase digits.
Enter sub-menus and shift right to the next digit when the parameter or digit is flashing.
Scroll down menus /sub-menus. Decrease digits.
spirax sarco
OK
Enters parameters when the parameter or digit is flashing. Hold down for 5 seconds to enter commissioning mode.

Fig. 9 Front panel display

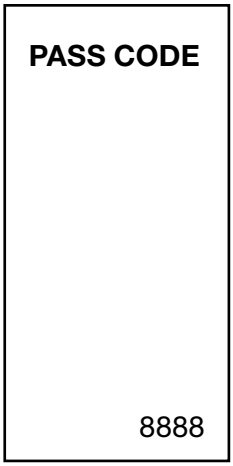
Warning: On entering the commissioning mode the product will cease normal control. The control relay will shut the valve. For safety, the alarm relay will continue to operate as normal. To regain normal control, return to the run menu.

Warning: If during commissioning, the buttons are not pressed for over 5 minutes, the controller will revert to run mode and an error will be displayed. If the commissioning was incomplete the controller may not provide the correct control.

Archive

6.1.1 Enter commissioning

This is done from the run mode by pressing and holding down the OK button for 5 seconds.

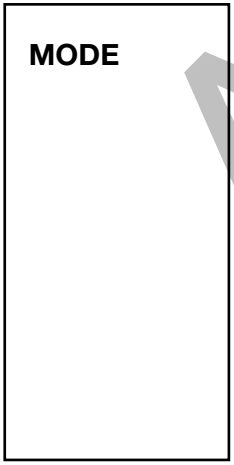


The run mode display will disappear and the display will show 'PASS CODE' with '8888' at the bottom right corner of the screen. The flashing leading digit indicates the position of the cursor. The default, or factory set pass code is 7452 but this can be changed from within the commissioning mode. The pass code can be entered by using the ∧ and ∨ buttons to increase or decrease the flashing value and the < and > buttons to move the cursor.

Pressing the OK button will enter the pass code. If an incorrect pass code is used, the display automatically returns to the run mode.

6.1.2 Commissioning mode navigation

After the correct pass code has been entered the display shows:



To exit the commissioning mode at any stage, press and hold the < button to return to the run mode.

Press the ∧ and ∨ buttons to scroll through the first level menus.

Press the > button to enter a particular sub-menu.

The first menu title will remain displayed at the top of the screen and the new sub-menu will appear on the next line. As you progress through the menu, the longer the list becomes. This aids navigation of the menu structure.

Archive

6.1.3 Changing settings (parameters)

If a particular sub-menu requires a parameter to be modified, the corresponding units (if any) will appear on the next line (in brackets) and the parameter itself will appear on the bottom right hand corner. The first digit will start flashing and the parameter can be modified.

If the OK button is pressed, the displayed value will be entered into memory. If the ◀ button is pressed the value remains unchanged. The sub-menu title, parameter and units will disappear, and the selection on the previous menu will be displayed.

Note: If a number is keyed in that is outside the parameters, an exclamation mark (**!**) will appear to the left of the parameter. The minimum or maximum acceptable parameter(s) will then be displayed.

Archive

6.2 Commissioning – Quick set-up

This section allows the user to carry out the minimum commissioning necessary to operate the system.

It accepts the defaults set in the factory, so will only work if the original default settings have not been altered – See Section 10.10, 'Default settings' to confirm.

Settings can then be tailored to suit the individual requirements of the customer/application if required.

Warning

It is essential that you comply with National/Local regulations and Guidance notes, and the boiler manufacturers' recommendations. It is imperative that the settings you have accepted will allow the boiler to operate in a safe manner.

Quick set-up – Commissioning

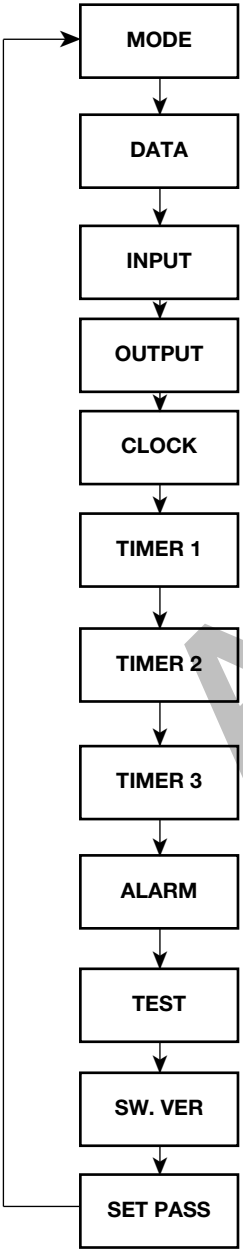
For a single boiler installation working Monday to Friday, without a blowdown valve switch fitted, and with a recovery time of 4 hours.

Parameter	Set to
1. Clock **-** Hours **-** Minutes **-** Month **-** Year	Actual time and date
2. Duration of blowdown	Depends on installation and water condition, but 5 seconds is the recommended maximum initially
3. Start time and date	Set time blowdown cycle is required (day, hour, minute)

Test the system to ensure that it is working correctly.

6.3 Commissioning - full

6.3.1 Main menu structure



Allows the user to view and change the valve status OFF, OPEN or AUTO.

Allows displayed units to be configured:-
Temperature in °C or °F, multiple timer priority and recovery time to allow blowdown vessel contents to cool.

Configures the link to switch box on the bottom blowdown valve.

Configures the output communications link.

Sets actual year, date and time.

Allows the user to set the first timer – time and duration, for example, when blowdown occurs and how long blowdown lasts.

Allows the user to set a second blowdown time and duration, if required. Used if, for example, a different blowdown time is required at weekends, or if more than one blowdown cycle is required per day.

As timers 1 and 2.

Warns if the valve does not lift off its seat in a given time. Set to OFF if the valve is to be opened manually without the alarm sounding. Latch/non latching option.

Allows the product display and functions to be tested.

Indicates the software version installed in the product.

Allows the user to set their own password

Archive

6.3.2 Commissioning via the sub-menus

Sub-menus and their functions are outlined below, and enable the user to programme the unit. Additional information is given where further choices can be made.

On selecting the sub-menu, the changeable variables will appear on the screen bottom right.

The initial parameter will be the value currently stored in memory. To change the parameter, scroll through the options using the ∧ and ∨ buttons. Note the parameters currently saved /selected will flash. To select a new parameter, press the OK button. To exit the sub-menu, press the < button.

6.3.3 MODE sub-menu

Allows the user to switch from automatic or manual control of the valve.

MODE

OPEN

Entering this menu (press the > button) allows the user to view the valve status settings, 'AUTO, OFF, or OPEN' - flashing:

- **OFF** The timer will give no blowdown.
- **OPEN** Continuous blowdown e.g. To drain the boiler.
- **AUTO** Automatic timed blowdown.

Toggle between the settings using the ∧ and ∨ buttons.

Select the required setting by pressing the OK button.

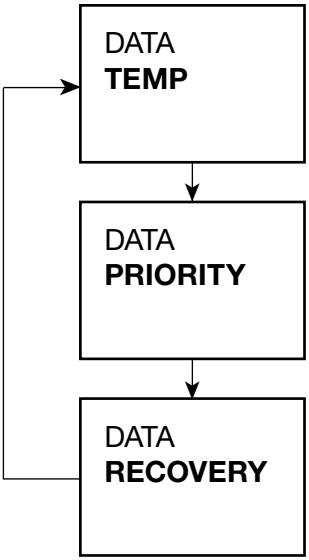
Press the < button to exit the sub-menu and return to the run mode.

NOTE: AUTO is the normal setting for timed blowdown.

Warning: This product will remain in the mode selected in both run and commissioning mode.
The boiler will be emptied if the controller is left in the OPEN mode.

Archive

6.3.4 DATA sub-menu



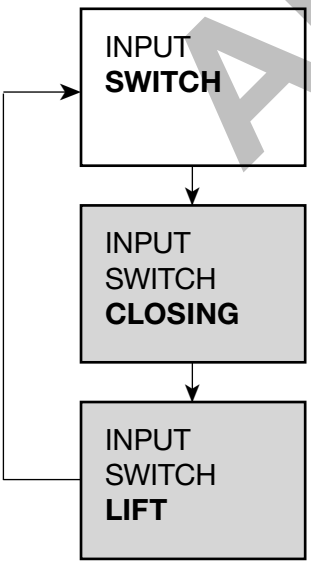
°F or °C (°C default).
Select the preferred option and press OK button.

Prevents more than one boiler blowing down at the same time. Selects which timer has priority (opens the blowdown valve first).
9 = highest priority and 1 = lowest priority
If the timer is not linked to other timers, set priority to '0'.

Sets time (in hours and minutes) for blowdown vessel to cool.
Setting the recovery time to 'zero' will clear any recovery time in process.

6.3.5 INPUT sub-menu

Sets link to burner and blowdown valve switch(es).



Switch fitted to blowdown - FITTED.
No switch on blowdown valve - NONE.
Select required setting.

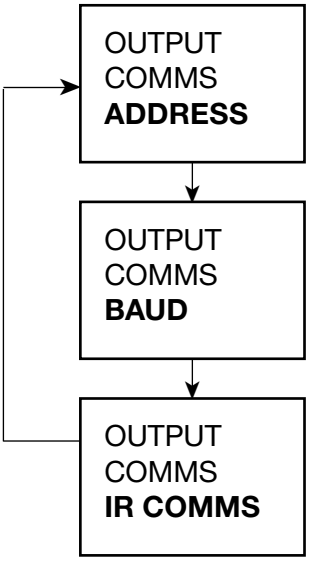
Only shown if the switch is FITTED.
Sets the delay time (seconds) before an alarm is signalled if a blowdown valve fails to close.
WARNING - Recommend maximum 5 seconds.

Only shown if the switch is FITTED and the alarm lift is ON.
Sets the delay time (seconds) before an alarm is signalled if a blowdown valve fails to lift of its seat (starts to open).

Archive

6.3.6 OUTPUT sub-menu

Selects MODBUS communication settings



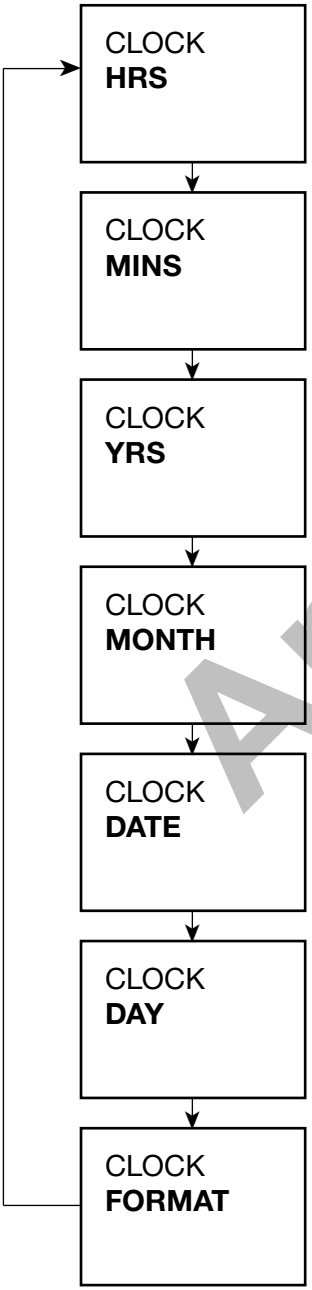
Address – This sets the address for Modbus communication. The default is 001, and the maximum is 247.

Baud rate defines the speed of communication between the product and an interrogating device in bits per second. The product can be set up to 1200, 9600 or 19200 Baud, with a default setting of 9600.

IR Comms – Sets Infrared master/slave configuration. Select SLAVE unless communication is required.

Archive

6.3.7 CLOCK sub-menu



HRS (24) sets time in hours.

Sets time in minutes.

Sets current year (e.g. 09).

Sets month (e.g. 05 for May).

Sets date (1-31).

Sets actual day of the week.
Note This is not day(s) on which blowdown occurs.

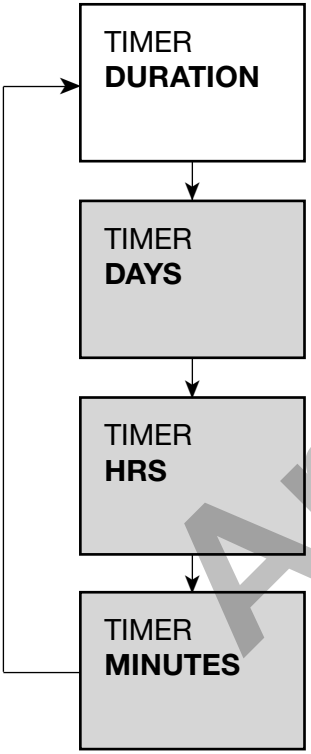
Sets date/month format.
Select day/month, as UK, Europe, or month/day, as USA.

Archive

6.3.8 TIMER sub-menu

This timer controls the bottom blowdown times and their duration.

The parameters will vary according to the type of boiler. Seek advice from a boiler manufacturer, insurance company, or a competent water treatment company. Timers 1, 2, and 3 are set in exactly the same way – see below:-



This is the time (in seconds) the blowdown valve is to open – the actual blowdown period. Seek advice from a boiler manufacturer, insurance company, or a competent water treatment company.
We recommend a 5 second duration initially.

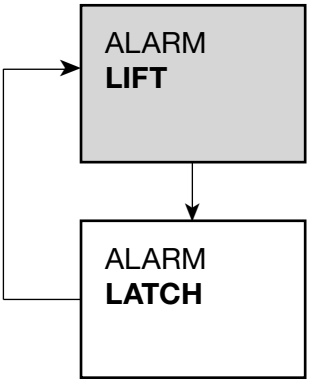
The range of days on which a blowdown cycle is to occur – Monday to Friday or Saturday, or Sunday. Not shown if the duration is set to zero.

This display shows the hour of the day that blowdown occurs. Not shown if the duration is set to zero.

This display shows the minute of the day that blowdown occurs. Not shown if the duration is set to zero.

Archive

6.3.9 ALARM sub-menu

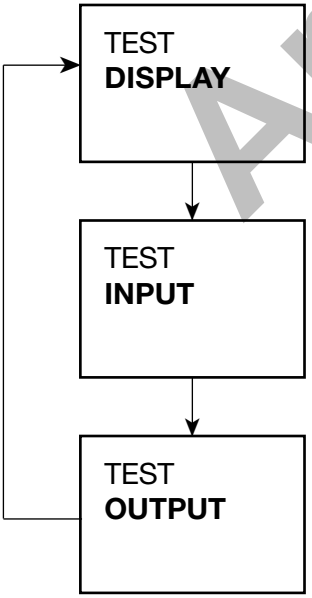


Only shows if the switch is FITTED. Set ON or OFF.
ON – The alarm will sound if the valve fails to lift within the time set in INPUT/LIFT.
OFF – No alarm.
Note: If ON selected, alarm will operate if MODE set to OPEN, or if valve is manually opened.

ON – Alarm will latch until commissioning mode is entered.
OFF – Alarm will only sound until the alarm condition is removed.

Archive

6.3.10 TEST sub-menu



Tests the display:
- (black on white or white on black).
- Allows the user to visually identify faulty pixels on the display.

Tests inputs:
INT TEMP - Shows maximum internal temperature of the electronics.
LINK - Detects if other boilers are blowing down. Will show 'ON' if MODE-OPEN is selected.
SWITCH - Detects if the switch is open or closed.

Tests outputs:
VALVE - Opens or closes valve manually.
ALARM - Energises/de-energises alarm relay manually.
CANCEL - Select cancel or wait 5 minutes to return to automatic control.

6.3.11 SOFTWARE VERSION sub-menu

SW VER

Allows the software version to be viewed. See separate literature for further information.

6.3.12 PASS CODE sub-menu

SET PASS

This allows the default pass code to be changed to a user-defined value. It is important that if the default pass code is changed that the new value is noted and kept safe.

Archive

7.1 Infrared (IR)

All products in the range can communicate via an infrared bus between adjacent controllers. It enables the parameters of up to seven slave products to be passed to a master product fitted with RS485 (products with a graphics display).

The product connected to the RS485 networks must be fitted on the left of all the slaves fitted to the IR bus (Figure 10) and have 'master' selected in the 'output-comms' menu.

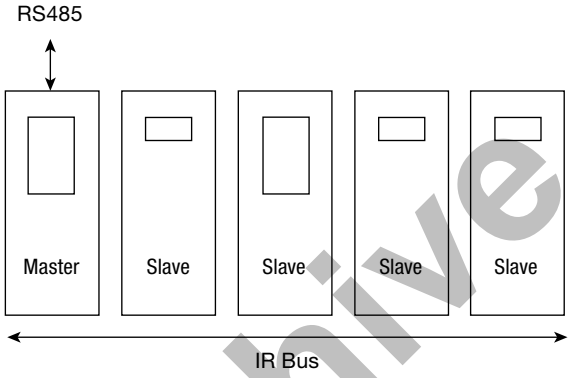


Fig. 10

Two or more IR buses can share the same enclosure or DIN rail by selecting another IR master. Master 2 will ignore bus 1. See Figure 11.

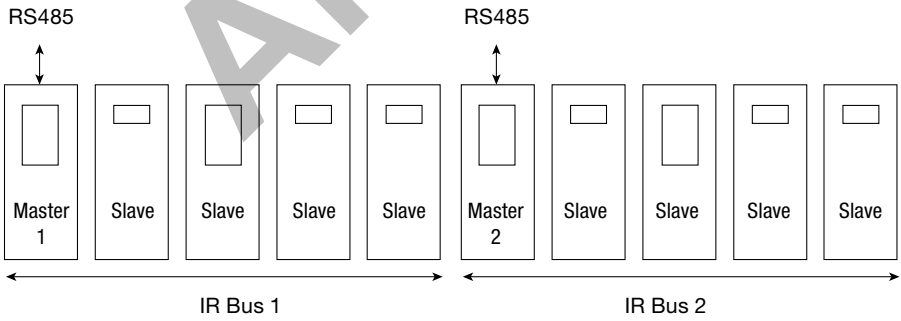


Fig. 11

To add another slave into an existing IR bus, re-select 'master'.

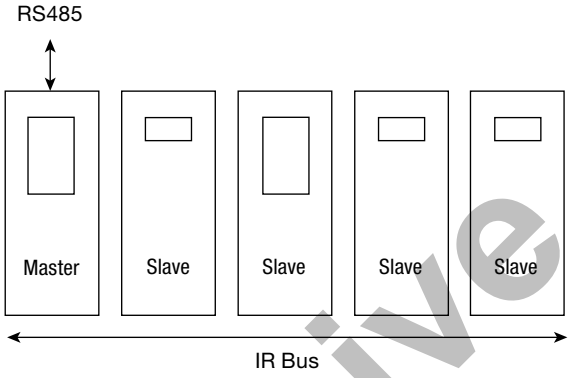
Only an IR master can pass the IR bus parameters to the RS485 network. If a slave is also connected to the RS485 network, only its parameters are passed.

Caution: Do not cover or obstruct the Infrared beam between products.

Archive

7.2 RS485 addressing

An offset is added to the register addresses (see above) for each device, depending on their position on the IR bus, i.e. the master's offset is 0, the device to its right hand side has an offset of 100, the one to its right 200 and so on.



IR address	1	2	3	4	5
RS485 Offset	0	100	200	300	400

Fig. 12

Archive

8. Maintenance

Note: Read the 'Safety information' in Section 1 before doing any maintenance.

8.1 Cleaning instructions

Use a cloth dampened with water or isopropyl alcohol. Use of other cleaning materials could damage the product and invalidate the marking.

No special servicing, preventative maintenance or inspection of the product is necessary. In many countries, including the UK, legal regulations are in force concerning boiler blowdown. In particular, attention is drawn to the danger of working on a shut-down boiler while other boilers are operating.

General guidance is given in Health and Safety Executive Guidance Note PM60.

The battery can be replaced, and must be removed before disposing of the product.

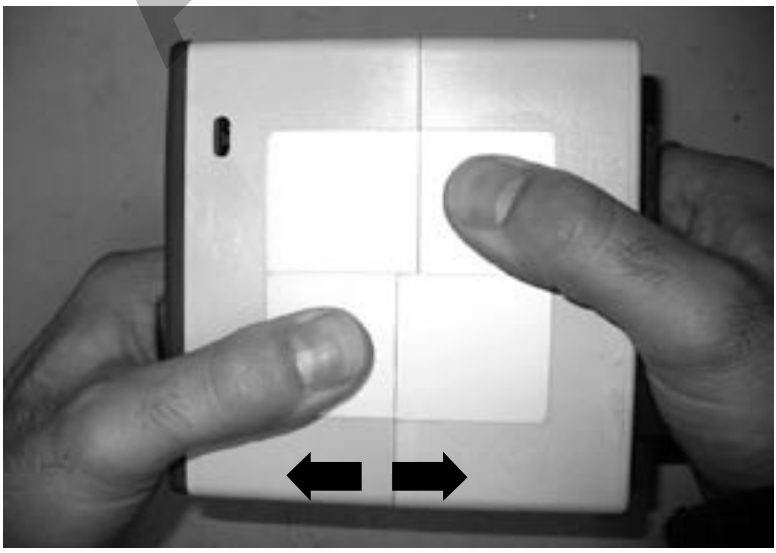
The battery must not be disposed of in waste destined for landfill or untreated incineration, but must be collected separately and disposed of in accordance with local and national regulations.

8.2 Replacement and disposal of battery

Caution: - Permanent damage will occur if the printed circuit board (pcb) is completely removed.
- Do not remove the front keypad.

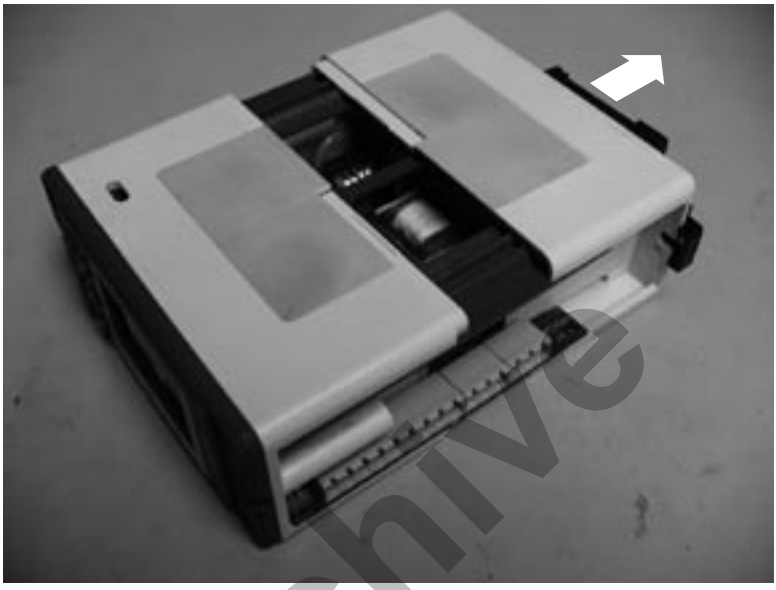
8.2.1 Cut the two side labels along the join line.

8.2.2 Squeeze enclosure in positions indictated to release locking tabs.

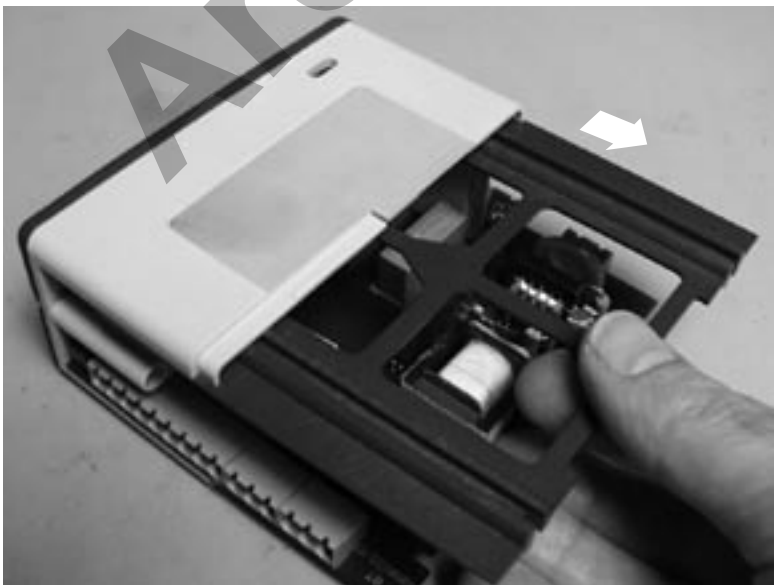


Archive

8.2.3 Remove the rear half of the enclosure only.

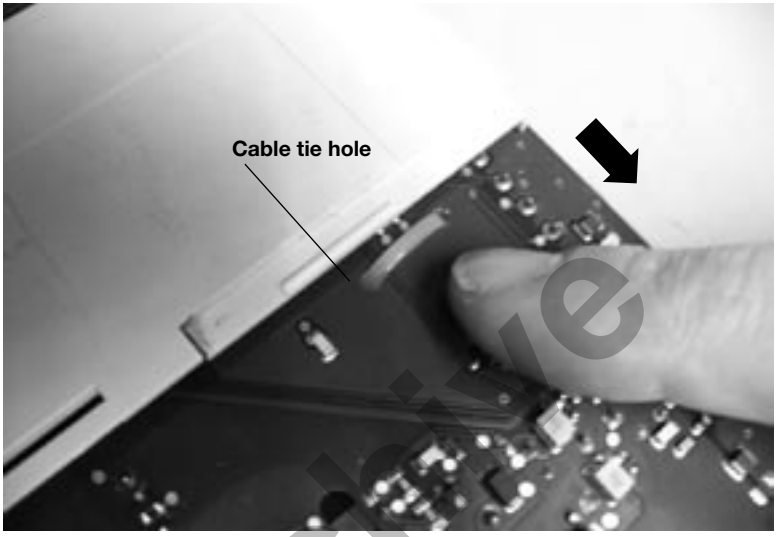


8.2.4 Remove the blue support.



Archive

8.2.5 **Caution: permanent damage will occur if the printed circuit board (PCB) is completely removed.** Slide the PCB out just far enough to access the cable tie securing the battery.



8.2.6 Cut the cable tie and lift the battery from the PCD.

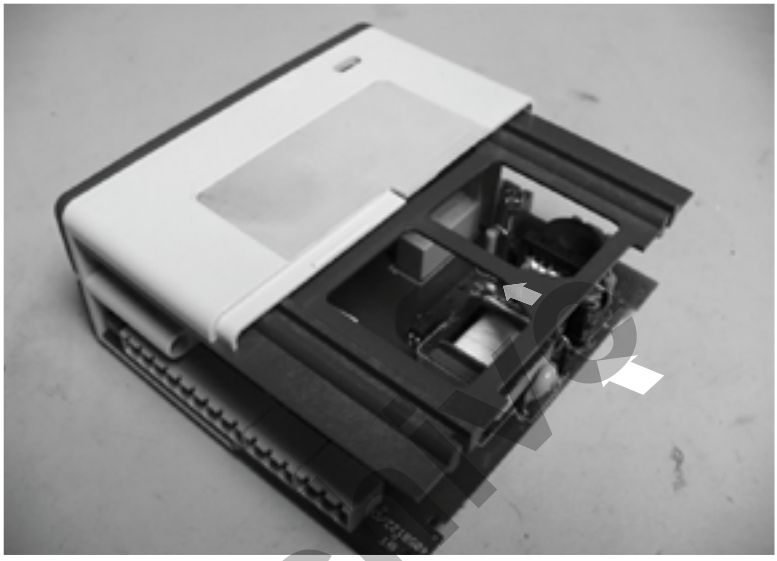
Archive

8.2.7 Insert the new battery. See Section 10.5 for the battery type.
Note: the battery is polarised and only fits one way round.

8.2.8 Thread a new cable tie through holes in the PCB, fasten securely around the battery and trim the end.

Archive

8.2.9 Slide the PCB fully back into position and refit the blue support. Ensure the arrow shapes on the support point toward the front.



8.2.10 Replace the rear half of the enclosure.

Archive

9. Fault finding

The most likely time for faults to occur is during installation and commissioning. The most common fault is incorrect wiring. If after applying power to the product an error message is displayed, it may be necessary to fault find. To simplify and aid in this process, the product has a Test menu (see Section 6.3.10 and 2.4).

WARNING:
Before fault finding read the Safety information in Section 1 and the General wiring notes in Section 5.1.

Please note that there are hazardous voltages present and only suitably qualified personnel should carry out fault finding.

The product must be isolated from the mains supply before opening enclosure and must be closed before power is reapplied.

Safety may be compromised if the fault finding procedures are not carried out in line with this manual.

Symptom	Action
1 **Display not illuminating**	**1.** Switch off the mains supply to the product. **2.** Check all wiring is correct. **3.** Check external fuse(s) are intact. Replace if necessary. **4.** Check the mains voltage is within specification. **5.** Switch on mains supply. If symptoms are still present return product for examination. Consider the likelihood that the product has been damaged from mains borne surges/spikes. Consider installing an additional ac power line protector between the product and the mains supply. The protector needs to be positioned close to the product to gain full protection.

Archive

Symptom	Action
2 **Display flashes on and off (1 second approx.)**	**1.** Switch off the mains supply to the product. **2.** Disconnect all signal wires. **3.** Switch the mains supply on: If symptoms are still present, return the product for examination. **4.** Replace each signal wire in turn until the fault occurs. **5.** Investigate and rectify any faults in the wiring, external sensors / transducers and modules associated with that connection. **Explanation** The internal power supply is unable to power up. If the voltages cannot be generated, the power supply switches off for approx. 1 second. The power supply then attempts to power up again. If the fault is still present, the cycle is repeated until the fault is removed. This is a safety feature and does not damage the product.
3 **Product powers up for a period of time (greater than 1 minute), then switches off**	**1.** Monitor the mains supply and ensure it is continuous and within the specification limits. **2.** Measure the ambient temperature and ensure it is less than specified. **3.** Investigate symptom 2. **Explanation** A re-settable thermal cut-out device will operate if one or more of the following occurs: - The power drawn exceeds the specification. - The input mains voltage is lower than specified. - The ambient temperature is higher than specified. - The internal power supply will switch off until the product temperature drops below 65°C. This is a safety feature and does not damage the product.

Archive

Operational error messages

Any operational errors that occur will be displayed in the run mode, on the alarms and errors screen.

Error message	Cause	Action
1 **Power out**	There has been a loss of power to the product during operation.	**1.** Remove the power from the product. **2.** Check that all the wiring is correct. **3.** Check that the power supply is secure, i.e. does not suffer from 'brown outs'. **4.** Reapply power. **5.** Press the OK button to clear.
2 **Valve failed to open**	Blowdown valve fails to start to open.	**1.** Check the correct open time has been entered in the INPUT-SWITCH-LIFT menu. **2.** Check BB valve switch in the test menu. **3.** Check the wiring between switch and the product. **4.** Check the operation of the switch. **5.** Check the operation of the valve. **6.** Check and replace the switch and/or valve if necessary. **7.** Press the OK button to clear.
3 **Valve failed to close**	Blowdown valve fails to close fully.	**1.** Check the correct closing time has been entered in the INPUT-SWITCH-CLOSING menu. **2.** See 'Valve failed to open'. **3.** Enter the commissioning mode and enter the correct pass code.
4-6 **Data timer X invalid**	Data in one of the three timers has been lost or corrupted. Values have been restored (X = 1 to 3).	**1.** Product needs to be re-commissioned. **2.** Ensure product or its wiring is not located near a source of electrical interference. **3.** Return product if symptoms persist. **4.** Press the OK button to clear.
7 **Data state MC overflow**	State machine is outside its limits. Values have been restored.	**1.** See 'Data timer' X 'Invalid' action. **2.** Press the OK button to clear.

Archive

Error message	Cause	Action
8 **Data recovery invalid**	Data in the recovery counter has been corrupted.	**1.** See 'Data timer X 'Invalid' action. **2.** Press the OK button to clear.
9 **Data flags invalid**	Data in the timer flag register has been lost or corrupted. Values have been restored.	**1.** See 'Data timer X 'Invalid' action. **2.** Press the OK button to clear.
10 **Data errors invalid**	Data in the error flag register has been lost or corrupted. Values have been restored.	**1.** See 'Data timer X Invalid' action. **2.** Press the OK button to clear.
11 **Setup menu time out**	The operator has entered the commissioning mode and has not pressed a button for 5 minutes or more.	**1.** Re-enter the commissioning mode if required. **2.** Press the OK button to clear.
12 **Alarm is latched**	Some errors latch the alarm relay for safety. Clearing the error from the error screen just removes the message.	**1.** Enter the commissioning (set-up) mode. If the correct password is entered all the latched alarms will be cleared.

Archive

10. Technical information

10.1 For technical assistance

Contact your local Spirax Sarco representative. Details can be found on order/delivery documentation or on our web site: **www.spiraxsarco.com**

10.2 Returning faulty equipment

Please return all items to your local Spirax Sarco representative. Please ensure all items are suitably packed for transit (preferably in the original cartons).

Please provide the following information with any equipment being returned:

1. Your name, company name, address and telephone number, order number and invoice and return delivery address.
2. Description and serial number of equipment being returned.
3. Full description of the fault or repair required.
4. If the equipment is being returned under warranty, please indicate:
   - Date of purchase.
   - Original order number.

Archive

10.3 Power supply

Mains voltage range	99 Vac to 264 Vac at 50/60 Hz
Power consumption	230 V/30 mA or 115 V/60 mA

10.4 Environmental

General		Indoor use only
Maximum altitude		2 000 m (6 562 ft) above sea level
Ambient temperature limits		0 - 55°C (32 - 131°F)
Maximum relative humidity		80% up to 31°C (88°F) decreasing linearly to 50% at 40°C (104°F)
Overvoltage category		III
Pollution degree		2 (as supplied)
		3 (when installed in an enclosure) - Minimum of IP54 or UL50 / NEMA Type 3, 3S, 4, 4X, 6, 6P or 13. See Section 4, Mechanical installation.
Enclosure rating (front panel only)		NEMA type 4 hose down only (UL approval) and IP65 (verified by TRAC Global)
Torque rating for panel screws		1 - 1.2 Nm
LVD (safety)		Electrical safety EN 61010-1
		UL61010-1, UL 508, Clause 23.2.
		CAN/CSA C22.2 No. 61010-1
EMC	Immunity/Emissions	Suitable for heavy industrial locations
Enclosure	Colour	Light grey (similar to RAL7035)
	Material	ABS polycarbonate plastic
Front panel	Colour	Pantone 294 (blue)
	Material	Silicone rubber, 60 shore.
Solder		Tin/lead (60/40%)

10.5 Battery (Clock calendar)

Manufacturer	TADIRAN
Manufacturers part number	SL-360/PT
Spirax Sarco part number	0965057
Type	AA (PCB tagged) Lithium Thionyl Chloride (Lithium content 0.65 g)
Voltage	3.6 V
Capacity	2.4 Ah minimum
Temperature range	0 - 70°C minimum
Shelf life	10 years - With battery switch OFF @ Tamb: 25°C
Working life	10 years - Mains power on 35 hours/week @ Tamb: 55°C

10.6 Cable/wire and connector data

Mains and signal connector

Termination	Rising clamp plug-in terminal blocks with screwed connectors
Cable size	0.2 mm² (24 AWG) to 2.5 mm² (14 AWG).
Stripping length	5 - 6 mm

Switch box and Lockout (link) circuit

Type	High temperature
Shield type	Screened
Number of cores	2
Gauge	1 - 1.5 mm² (18 - 16 AWG)
Maximum length	100 m (328 ft)
Recommended type	Prysmian (Pirelli) FP200, Delta Crompton Firetuf OHLS

RS485 communication cable/wire

Type	EIA RS485 Twisted pair
Shield type	Screened
Number of pairs	2 or 3
Gauge	0.23 mm² (24 AWG)
Maximum length	1 200 m (4 000 ft)
Recommended type	Alpha wire 6413 or 6414

LAN Category 5 or Category 5E ScTP (screened), FTP (foil) or STP (shielded) cable can be used, but limited to 600 m.

Archive

10.7 Input technical data

Switch box

Maximum voltage	32 Vdc (no load, open circuit)
Maximum current	3 mAdc (short circuit)

Lockout (link)

Maximum voltage	32 Vdc (no load, open circuit)
Maximum pulldown voltage	0.25 Vdc
Maximum current	1.5 mAdc

10.8 Output technical data

Relay(s)

Contacts	2 x single pole changeover relays (SPCO)
Voltage ratings (maximum)	250 Vac
Resistive load	3 amp @ 250 Vac
Inductive load	1 amp @ 250 Vac
ac motor load	¼ HP (2.9 amp) @ 250 Vac
	$^{1}/_{10}$ HP (3 amp) @ 120 Vac
Pilot duty load	C300 (2.5 amp) - control circuit/coils
Electrical life (operations)	3 x 10^{5} or greater depending on load
Mechanical life (operations)	30 x 10^{6}

RS485

Physical layer	RS485 4-wire full or 2-wire half duplex
Protocol	Modbus RTU format
Isolation	60 Vac/dc
Receiver unit load	⅛ (256 devices - maximum)
Output rate	Up to 10 frames / second

10.9 Infrared

Physical layer	IrDA
Baud	38400
Range	10 cm
Working angle	15°
Eye safety information	Exempt from EN 60825-12: 2007 Safety of laser products- does not exceed the accessible emission limits (AEL) of class 1

Archive

10.10 Default settings

10.10.1 MODE MENU

Allows the valve to be manually opened or closed, automatically opened and closed under the control of the timer

Ranges	AUTO, OPEN, OFF
Default	AUTO

10.10.2 DATA MENU

TEMP (temperature units)

Ranges	°C or °F
Default	°C

PRIORITY

Ranges	0 - 9 (Highest priority)
Default	0 (Timer not linked)
Resolution (steps)	1

10.10.3 RECOVERY (flash vessel cooling time - after previous blowdown)

HRS – HOURS

Ranges	00 - 11
Default	4
Resolution (steps)	1
Units	Hours (HRS)

MINS – MINUTES

Ranges	00 - 59
Default	00
Resolution (steps)	1
Units	Minutes (MIN)

10.10.4 INPUT MENU

SWITCH (if a switch is fitted to the valve, select fitted)

Ranges	FITTED or NONE
Default	NONE

CLOSING (time allowed for valve to close) – Only available if a switch is fitted

Ranges	0 - 10
Default	5
Resolution (steps)	1
Units	Seconds

LIFT (time allowed for valve to lift of the seat) – Only available if a switch is fitted

Ranges	0 - 10
Default	5
Resolution (steps)	1
Units	Seconds

Archive

10.10.5 OUTPUT MENU

COMMS – ADDRESS (MODBUS communication)

Ranges	0 - 247
Default	1
Resolution (steps)	1

COMMS – BAUD (MODBUS communication)

Ranges	1200, 9600, 19200
Default	9600

COMMS – IR (Infrared communication)

Ranges	MASTER or SLAVE
Default	SLAVE

COMMS – IR (units in network)

Ranges	1 - 8

10.10.6 CLOCK MENU

HRS – HOURS ~ 24 hour format (clock calendar)

Ranges	00 - 23
Default	00
Resolution (steps)	1
Units	Hours (HRS)

MINS – MINUTES

Ranges	00 - 59
Default	00
Resolution (steps)	1
Units	Minutes (MINS)

YRS – YEARS

Ranges	00 - 99 (2000 - 2099)
Default	00
Resolution (steps)	1
Units	Years (YRS)

MONTH

Ranges	01 - 12
Default	01
Resolution (steps)	1

DATE

Ranges	01 - 31
Default	01
Resolution (steps)	1

DAY

Ranges	MON, TUE, WED, THUR, FRI, SAT, SUN
Default	SUN

FORMAT

Ranges	D/m or m/d
Default	D/m

Archive

10.10.7 TIMER X (1 - 3) MENU

DURATION (valve open time)

Ranges	0 - 999
Default	0
Resolution (steps)	1
Units	Seconds

Note: If the mains power supply drops below the required specification, or power down occurs during a blowdown, the relays will de-energize and close the valve. If the mains supply is restored after the blowdown time has elapsed, the valve will remain shut until the next scheduled blowdown time.

DAYS
(range of days blowdown occurs) Only available if the duration is greater than 0 seconds

Ranges	MON - FRI or SAT or SUN
Default	MON - FRI

HRS
(Hour of day blowdown occurs) Only available if the duration is greater than 0 seconds

Ranges	00 - 23
Default	00
Resolution (steps)	1

MINS
(Minute of day blowdown occurs) Only available if the duration is greater than 0 seconds

Ranges	00 - 59
Default	00
Resolution (steps)	1

Archive

10.10.8 ALARM MENU

LIFT (alarms occurs if the valve does not lift of the seat within lift time)
Only available if the switch is fitted and selected

Ranges	ON or OFF
Default	ON

LATCH (alarm relay can be latched until commissioning mode is entered)
Only available if the switch is fitted and selected

Ranges	ON or OFF
Default	OFF

10.10.9 TEST MENU

DISPLAY

Ranges	Black-on-white or white-on-black
Default	Black-on-white

INPUT - INT TEMP
(Maximum internal temperature of the electronics)

Ranges	-40 to +85°C or -40 to +185°F
Resolution (steps)	1
Units	°C or °F

INPUT - LINK
(detects if other boilers are blowing down)

Ranges	ON or OFF

INPUT - SWITCH
(detects if the switch is open or closed) Only available if the switch is selected

Ranges	OPEN or CLOSED

OUTPUT - VALVE
(opens or closes valve manually)

Ranges	ON or OFF
Default	ON

Press the OK button to activate relay - Automatic control of relays is selected by selecting cancel or after 5 minutes has elapses.

OUTPUT - ALARM (De-energises or energises the alarm relay manually)

Ranges	ON or OFF
Default	ON

Press the OK button to activate relay - Automatic control of relays is selected by selecting cancel or after 5 minutes has elapsed.

10.10.10 SET PASS MENU (Set pass code)

Ranges	0000 - 9999
Default	7452
Resolution (steps)	1

Archive

11. Appendix - Summary of the Modbus protocol

Format: Byte

Start	1 bit
Data	8 bit
Parity	0 bit
Stop	1 bit

Format: Request frame

Address	1 byte
Function code	1 byte
Start address	2 bytes
Quantity of registers	2 bytes
Cyclic redundancy check (CRC)	2 bytes
Total	8 bytes

Format: Response frame

Address	1 byte
Function code	1 byte (or error code, see below)
Byte count	1 byte (or exception code, see below)
Register data	2 bytes, most significant first
Error check (CRC)	2 bytes
Total	7 bytes if correct (or 5 bytes if in error)
Only Function Code 03, 'Read holding registers' is allowed.	

Parameters and register data

Register	Parameters
0	6 - Identity
1	Timer 1 data (day)
2	Timer 1 start (time)
3	Timer 1 duration (seconds)
4	Timer 2 data (day)
5	Timer 2 start (time)
6	Timer 2 duration (seconds)
7	Timer 3 data (day)
8	Timer 3 start (time)
9	Timer 3 duration (seconds)

The format of the register data is 16 bit integer, with the most significant byte transmitted first.

Exception codes

01 illegal function
02 illegal data address

Archive

Parameter	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5
	Device Address	Function Code	Exception Code	CRC (LSB)	CRC (MSB)
Illegal function	XX	83	01	XX	XX
Illegal data address	XX	83	02	XX	XX

The Modbus Cyclic Redundancy Routine (CRC) is defined as follows:

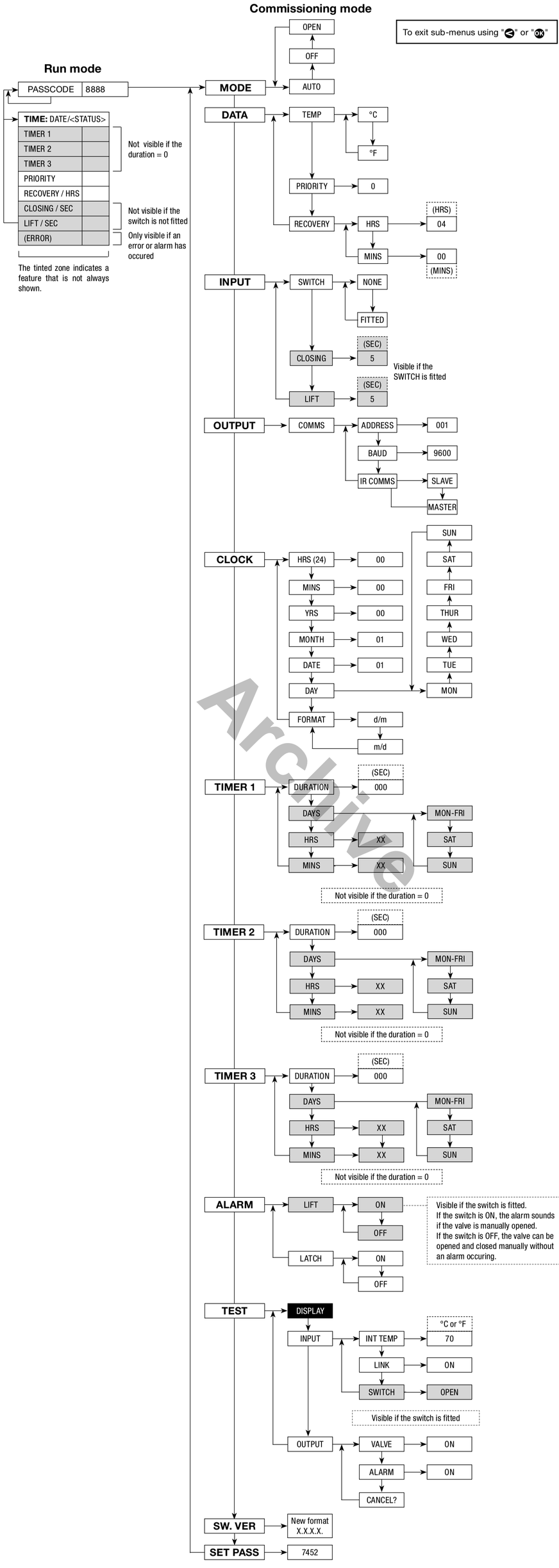
- First load the 16 bit CRC register with FFFF hex.
- Copy an 8 bit data character into the least significant byte of a 16 bit register, setting the most significant byte (MSB) = 00 hex.
- Exclusive-or (XOR) this with the CRC register contents.
- If the least significant bit (LSB) of the result is 0, the CRC is shifted right.
- If the LSB is 1, the CRC is shifted right, then XOR'ed with A001 hex.
- This is repeated for all 8 bits of the data character, the most significant bit after the shift is filled with a 0.
- After the 8th shift, the next data char is XOR'ed with the CRC's current value.
- Repeat for all characters.
- Transmit the resulting 2 byte CRC LSB first.

Modbus CRC programme in BASIC

```
Dim crc
Dim TempCrc
Dim i As Integer
Dim j As Integer
Dim Character
        crc = 65535

For i = 1 To Len(message)
        Character = Asc(Mid$(message, i, 1))
        crc = crc Xor Character
        For j = 1 To 8
                TempCrc = (crc / 2)
                If Int(TempCrc) <> TempCrc Then
                        TempCrc = Int(TempCrc)
                        TempCrc = TempCrc Xor 40961
                End If
                crc = TempCrc
        Next j
Next i
Calculate CRC = crc
```

Archive


Commissioning mode
To exit sub-menus using "⊖" or "ok"
Run mode
PASSCODE
8888
TIME: DATE/<STATUS>
TIMER 1
TIMER 2
TIMER 3
PRIORITY
RECOVERY / HRS
CLOSING / SEC
LIFT / SEC
(ERROR)
Not visible if the duration = 0
Not visible if the switch is not fitted
Only visible if an error or alarm has occured
The tinted zone indicates a feature that is not always shown.
MODE
OPEN
OFF
AUTO
DATA
TEMP
°C
°F
PRIORITY
0
RECOVERY
HRS
(HRS)
04
MINS
00
(MINS)
INPUT
SWITCH
NONE
FITTED
CLOSING
(SEC)
5
Visible if the SWITCH is fitted
LIFT
(SEC)
5
OUTPUT
COMMS
ADDRESS
001
BAUD
9600
IR COMMS
SLAVE
MASTER
CLOCK
HRS (24)
00
MINS
00
YRS
00
MONTH
01
DATE
01
DAY
MON
SUN
SAT
FRI
THUR
WED
TUE
FORMAT
d/m
m/d
TIMER 1
DURATION
(SEC)
000
DAYS
MON-FRI
HRS
XX
SAT
MINS
XX
SUN
Not visible if the duration = 0
TIMER 2
DURATION
(SEC)
000
DAYS
MON-FRI
HRS
XX
SAT
MINS
XX
SUN
Not visible if the duration = 0
TIMER 3
DURATION
(SEC)
000
DAYS
MON-FRI
HRS
XX
SAT
MINS
XX
SUN
Not visible if the duration = 0
ALARM
LIFT
ON
OFF
Visible if the switch is fitted.
If the switch is ON, the alarm sounds if the valve is manually opened.
If the switch is OFF, the valve can be opened and closed manually without an alarm occuring.
LATCH
ON
OFF
TEST
DISPLAY
INPUT
INT TEMP
°C or °F
70
LINK
ON
SWITCH
OPEN
Visible if the switch is fitted
OUTPUT
VALVE
ON
ALARM
ON
CANCEL?
SW. VER
New format X.X.X.X.
SET PASS
7452

Archive

Archive

Archive

Archive